Technology and Realtor® Income

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Abstract:

The ever-expanding use of the Internet and various other information technologies may directly impact the income levels of the real estate brokerage community. With a database of more than 6,000 usable observations from the 1999 National Association of Realtors® member profile, we examine the impact of technology usage on the incomes of Realtors®. In a two-step procedure, we first develop factor loadings, using factor analysis, for multifaceted technology usage by Realtors®. Then we perform a regression analysis of Realtors® income incorporating a variety of independent variables representing licensee (brokers and salespersons) demographics and brokerage firm characteristics as well as the factor score for technology usage. Our results show that the use of the Internet and other information technologies is positively related to the earnings of Realtors®.

In a second regression analysis, we use our technology factor score to determine which of a variety of individual Realtor® demographic and brokerage firm characteristics are more related to technology usage than other characteristics. We find that technology usage increases with schooling, number of firms for which the agent has worked, marriage, franchise affiliation, firm size, ownership interest, and hours worked. By contrast, technology usage falls with age, and usage is lower for females and nonwhites. The results of this paper expand our knowledge concerning familiarity with and use of real estate technology and related income.
Key Words: Internet, earnings, realtors, technology, income, e-mail, web, broker, brokerage

Article:

1. Introduction

There are a number of forces, both from inside and outside the real estate industry, which affect the income levels of the real estate broker community. Inside forces such as real estate brokerage firm consolidations or mergers impact the operating structures of brokerage firms and their Realtors®. Outside forces such as fluctuating interest rates, demographic changes, and changing information technology affect brokerage activity. The rapid increase in information flow made possible by technological advances such as the Internet for e-mail and for personal or company Web sites, online real estate financing sources, cellular phones, and personal digital assistants such as the Palm Pilot, along with other transforming information technologies, all allow for greater Realtor® productivity and efficiency. Greater productivity and efficiency could, therefore, lead to greater Realtor® income.1 This paper examines how use of new information technology by Realtors® influences the income of Realtors®.

Using more than 6,000 usable observations from the 1999 National Association of Realtors® member profile survey, we examine the impact of technology usage on the income levels of Realtors®. Factor analysis captures the multifaceted effects of technological change in a two-step procedure. First, we develop factor loadings for eight different measures of technology usage. We then perform a regression analysis of Realtors® income using a variety of licensee (real estate brokers and salespersons who are Realtors®) demographic and brokerage firm characteristic variables along with our factor score for technology usage. Our results show that the use of the Internet and other types of information technologies is positively related to earnings of Realtors®.

In a second regression analysis, we use our technology factor score to capture how a variety of specific Realtor® demographics and brokerage firm characteristics affect the use of technology. We find that technology usage rises with schooling, number of firms for which the agent has worked, marriage, franchise affiliation, firm size, ownership interest, and hours worked. Technology usage falls, by contrast, with age, sex, and race. This paper findings should increase our knowledge concerning those technology variables that impact real estate brokerage productivity and income.

This paper is divided into six sections. Sections 2 and 3 examine prior research on technology and the earnings of Realtors® and how the use of innovative multiple technologies could impact the incomes of Realtors®. Section 4 describes our theoretical model. Section 5 discusses the survey data and empirical findings. We conclude the paper with a summary of our findings and provide some observations.

2. Prior research on technology and the earnings of Realtors®

Prior research has looked at the factors that influence Realtors® earnings, but few studies have examined the impact of enhanced information technology on the earnings of brokers. Past studies develop models which explain the distribution of earnings in real estate sales based on the human capital earnings model developed by Mincer (1970). These models basically express income as a function of education, work experience, and firm size, along with other variables. In a recent extensive literature review of these prior studies that examine the determinants of real estate brokerage firm and licensee incomes, Benjamin et al. (2000) report that many factors influence real estate licensee income both positively and negatively. As shown in Table 1, these positive factors include (a) number of hours worked, (b) experience, (c) education, (d) firm size, (e) manager/ownership interest, (f) firm reputation, (g) franchise affiliation, (h) working in a metro area, (i) professional

Table 1. Factors influencing Realtors® incomes.

Factor	Positive	Negative	Unknown
Number of hours worked	Yes		
Experience	Yes		
Schooling	Yes		
Firm size	Yes		
Manager/ownership interest	Yes		
Firm reputation	Yes		
Franchise affiliation	Yes		
Working in a metro area	Yes		
Professional designations	Yes		
Level of job satisfaction	Yes		
Having personal assistants	Yes		
Selling residential property		Yes	
Holding a sales (instead of brokers) license		Yes	
Negative perceived image of the industry		Yes	
Female		Yes	
Technology			Yes

Source. From Benjamin et al. (2000).

designations, (j) level of job satisfaction, and (k) having personal assistants; the factors that negatively affect licensee income are (a) selling residential property, (b) holding a sales license as opposed to being a broker, (c) having a perceived negative image of the industry, and (d) being female.

Three recent papers investigate the impact of new information technology on the earnings of brokers. Sirmans and Swicegood (2000) survey active Florida real estate brokers and find that low-income agents use computers no less intensively than high- income agents. Jud et al. (2000) also examine the impact of information technology on real estate licensee income. The authors use 292 completed surveys (out of 983 surveys sent for a 29.7 percent response rate) of real estate licensees who are members of the Greensboro Regional Realtors® Association (in North Carolina). Their combination of factor analysis and regression modeling shows that use of information technology has a positive impact on the earnings of real estate licensees.

The third paper, published by the National Association of Realtors® (1999) suggests that new information technologies have influenced real estate sales, as reported by its membership. Even though the real estate industry remains essentially a people-to-people business with "high touch," real estate professionals have adopted information technology to attract and retain clients. Almost 90 percent of Realtors® surveyed use a computer, and the rate of usage is indifferent to age, experience, and level of education. The report shows that Realtors® who use computers earn on average $22,600 more than non-computer using Realtors®. Note, however, this report does not argue that the use of computers leads to a higher income.

Another study, by MacGregor and Bunker (1999), presents the results of a survey concerning the use of technology by Australian real estate brokers, but does not examine the technology and broker income relationship.

3. Technology and its impact on real estate brokerage

Information technology has changed the methods by which real estate brokerage is practiced. The procedures broker and salespersons use to market real estate (as well as their services) and the involvement of home sellers and buyers (now respected as information "empowered consumers") in the real estate transaction have been altered by information enabling technologies such as the Internet for e-mail and personal/company Web sites, cellular phones, faxes, and other information technologies. No longer does the simple real estate sales–purchase transaction typify how real estate brokerage works. Brokerage firms and their agents now facilitate information exchange to make the real estate sales/purchase/financing transaction work by increasingly embracing information technologies to speed the completion of tasks necessary to market the property and to close the real estate transaction.2

Several economic and technological developments have impacted real estate brokerage. Players from other industries are incorporating real estate services into their product offerings, and new and existing players are exploring ways to radically change the way homes are bought and sold. Firm profitability is decreasing due to a squeeze on revenues after commission splits arising from increased competition and monetary compensation for top listing and selling agents, along with increasing firm fixed operating expenses. Furthermore, information empowered consumers are impacting Realtors® performance and pay.

Firms are struggling to address uncertainty and expense associated with these technological and economic changes. A recent report by Bank of America Securities predicts that real estate brokerage commissions, which at present total some $18.8 billion annually, will fall 11 percent over the next three years (Rich, 2000). Realty firms and agents need to build new capabilities to leverage technology.

Perhaps the major change wrought by technology on the practice of real estate is the expanded availability of and access to real estate related information. With the advent of the Internet, consumers themselves—homebuyers and sellers—can surf the web and review the majority of resale property listings. As consumers have become information "empowered" customers, the value proposition for real estate brokerage has shifted, affecting a sea change in what services real estate professionals must provide to clients.

In the past, the real estate professional has been the gatekeeper to all property information through its multiple listing service (MLS). By cooperating and sharing information through their MLS, brokers have reduced the cost and raised the efficiency of search. Because access to the MLS is frequently limited to member brokers,3 many believe that the MLS represents an informational monopoly for members.

Now, the source of information is shifting to the Web. Online consolidators of free real estate information and services (which rely on advertising and fees paid by real estate agents and brokers for profits) complete with traditional real estate organizations for primacy in information and service. New cyberspace technology is making the housing search cheaper, easier, and more flexible (Tressler, 1999). Real estate Web sites such as NAR's official site Realtor.com and Microsofts HomeAdvisor.com allow potential buyers to search available properties by location

or zip code and narrow the search by specifying information on desired amenities and price range. Many sites provide virtual tours of home interiors, allowing buyers a 360° view of each room. Web sites also provide basic information about the home-buying process, loan qualification, and other real estate transaction basics. Tax rates, school test scores, crimes rates, etc. as well as links to service providers such as mortgage bankers, moving companies, utility providers, etc. can be found on the Internet. Some sites provide tools such as mortgage loan calculators and links to online appraisal services—all free to customers.

As commercial-based sites compete in offering services, the resulting inherent dynamic will create substantial change in the brokerage industry and the way services are provided. The National Association of Realtors® has sought to protect their members special position in the housing market by investing and promoting Realtor.com, which is owned and operated by online real estate company Homestore.com Inc (Barta, 2000). Realtors® have responded to a potential threat caused by the Internet with proprietary agreements between local multiple listing services and Homestore.com (minus address of properties and the phone numbers of sellers). A new initiative of NAR, e-Realtor.com allows buyers, sellers, and others involved in a housing market transaction to exchange documents online (Barta, 2000), a service offered free only to buyers and sellers who employ a Realtor® in their housing search.

This widening of information should allow market participants to make better-informed decisions at lower costs. From an industry perspective, however, the demand for brokerage services is a function of the cost of search, and declining search costs reduce the demand for brokerage services. Because the Internet can make real estate market search easier and can provide more information at a lower cost, it may reduce the demand for real estate brokerage services.

The question is how great is the impact of technology on the incomes of real estate professionals. Does having detailed listing information on the Internet completely substitute for the services provided by a real estate agent or does it simply replace secondary information sources such as newspapers and Realtor® sponsored open houses? A 2000 study by the National Association of Realtors® finds that the Internet has not yet had a detrimental impact on the business of Realtors®. In 1999, 37 percent of homebuyers reported using the Internet as an information source during their home search (up from just two percent in 1995); however, only four percent of homebuyers first learned about the home that they ultimately purchased from the Internet. As a comparison, 49 percent of 1999 homebuyers first learned about the home that they purchased from a real estate agent or broker, virtually unchanged from ten years earlier. Further, out of the 37 percent of homebuyers who reported using the Internet for their home search, 87 percent used a real estate agent or broker to finish their home search and complete the transaction; for homebuyers who did not use the Internet for their home search, only 76 percent used a real estate broker or agent to complete it. Apparently, homebuyers may use the Internet as a secondary information source, much like newspapers, open houses, and home magazines.

Nevertheless, customers today expect much more of a real estate agent. They expect the real estate professional to use the latest technology to meet their needs. Consumers demand more information and a more efficient delivery system that is easy to use, interesting, and personalized. Seamless transaction platforms that enable online transactions will in turn have an

impact on the traditional business models and practices that rely on commission oriented structures. Yet the home buying/selling transaction will remain high-touch, with buyers and sellers relying on real estate professionals to satisfy key needs for security and accountability and to optimize gross sales price. While brokers remain major players in the transaction, adoption of technologies that increase a firms effectiveness will be essential for continued success.

4. A model of Realtors® earnings

In the current environment, competitive pressures and the falling price of information technology are leading more and more brokers and brokerage firms to employ more information technology in their business. Because the market for brokerage services is competitive, brokers and salespersons can expect to receive the value of their marginal product (MP_L), that is:

$$\text{Wage} = P^* \text{MP}_L. \qquad (1)$$

And because information technology is a factor in the production of brokerage services, the increased utilization of such technology raises the brokers marginal product and, thus, his or her level of income, other things equal. It is reasonable to expect that in the current industry environment of rapid technological change those brokers who utilize the new information technology most intensively will earn higher incomes than other equally qualified brokers who exploit the technology less intensively.4

We use the standard human capital earnings model, developed by Mincer (1970), to investigate the impact of information technology usage on Realtors earnings. Using demographic information, brokerage firm characteristics, and information technology usage, a general form of the earnings model of Realtors respondents is as follows:

$$\begin{aligned} LINC = \text{f}\ (&Lhrs,\ Sch,\ Exp,\ Exp2,\ Expf,\ Naff,\ Female,\ Married,\ Nwhite,\\ &Broker,\ Fran,\ Lfsize,\ BuyAgt,\ Owner,\ ME,\ GL,\ PR,\ SE,\ SW,\\ &RM,\ FW,\ Multitech) \end{aligned} \qquad (2)$$

where

LINC = the natural log of annual earnings from all real estate activities,
Lhrs = the natural log of the number of hours worked in real estate,

Sch = the number of years of schooling based on highest level of education completed,
Exp = the number of years of real estate experience,
Exp2 = the number of years of real estate experience squared,
Expf = the number of years of experience with the present firm,
Naff = the number of real estate firms that the respondent has been affiliated,
Female = a dummy variable indicating the gender of the respondent,
Married = a dummy variable indicating the respondent is married,
Nwhite = a dummy variable indicating non-white race of the respondent,
Broker = a dummy variable indicating the respondent holds a brokers license,
Fran = a dummy variable indicating a national franchise affiliation,
Lfsize = the natural log of the brokerage firm size,
BuyAgt = a dummy variable indicating a buyer agency exclusivity,
Owner = a dummy variable indicating the respondent is the firm owner,
ME = a dummy variable indicating residence in the BEA Mideast region,[5]
GL = a dummy variable indicating residence in the BEA Great Lakes region,
PR = a dummy variable indicating residence in the BEA Plains Region region,
SE = a dummy variable indicating residence in the BEA Southeast region,
SW = a dummy variable indicating residence in the BEA Southwest region,
RM = a dummy variable indicating residence in the BEA Rocky Mountain region,
FW = a dummy variable indicating residence in the BEA Far West region, and
MultiTech = a factor score measuring the Realtors® usage of information technology.

The technology variable or MultiTech, which represents the multifaceted use of information technology, is found through a factor analysis of eight technology variables:

$$MultiTech = f(Software, Email, Internet, Pweb, Cweb, WebLink, Online, TechItem) \quad (3)$$

where

Software = the number of types of real estate software packages used,
Email = a dummy variable indicating the frequent use of e-mail,
Internet = a dummy variable indicating the frequent use of the Internet,
Pweb = a dummy variable indicating a personal Web page for real estate business purposes,
Cweb = a dummy variable indicating a company Web page for real estate business purposes,
Weblink = the number of real estate related links connected to the respondents personal Web page,
Online = measures the online use of the web, and
TechItem = measures the total number of different information technologies (out of a possible eleven) used by the respondent.

Software represents the number of types of real estate software packages utilized by the Realtor®. Email is comprised of survey respondents who frequently use e-mail. Frequent use of the Internet is proxied by the variable Internet. PWeb represents whether the survey participant has a personal Web site used for real estate business purposes, while CWeb reflects whether or not the Realtors® firm has a Web site. The variable Weblink reflects the number of real estate related links connected to each Realtors® personal Web page.6 Online measures used by Realtors® of the Web for shopping online, their participation in business related online discussions, and their use of the Internet to find industry information. Finally, TechItem

measures the total number of different information technologies used out of a possible eleven technologies (for example, beeper/pager, cellular phone, digital camera, PDA, etc.).7

5. Survey data and empirical results

The data for this study are obtained from a recent survey of Realtors®. In January 1999, the economic Research Group of the NATIONAL ASSOCIATION OF REALTORS® (NAR) sent a membership profile questionnaire to 40,000 randomly selected members of the NAR.8 Respondents returned 7,655 usable questionnaires representing a 19.1 percent response rate.

Table 2 presents the summary statistics for the 7,655 survey respondents. Approximately 52 percent of the survey participants are female (Female) with 73.3 percent being married (Married). The percentage of Realtors® who are non-white (Nwhite) is only 8.5 percent and includes 2.9 percent who are of Latin descent. Approximately 28 percent of the participants are brokers. The average years of real estate related work experience (Exp) is 14.6 years with a very large standard deviation of 10.3. Work experience with the existing firm (Expf) averages 7.9 years and ranges from 0 to 87 years. The average number of other real estate brokerage firms that the Realtor® has been affiliated with (Naff) is 1.25. Owners of real estate firms (Owner) represent 2.4 percent of the respondents. Participants work an average (HRS) of 42.0 hours per week, and they have completed 14.5 years of formal schooling (Sch). A total of 44.5 percent are affiliated with a national franchise or work for a subsidiary of a national or regional company (Fran). The average size of the sales force employed in the office where respondents work (Fsize) is 22.9, with a sample range from 4 to 50. Buyers agency (BuyAgt) is exclusively practiced by only 7.2 percent of respondents.

The largest percentage of respondents live in the Southeast region (SE), whichis the area of residence reported by 25.3 percent. Among the other regional areas, 14.3 percent live in the Northeast (NE), 13.1 percent in the Far West (FW), 11.9 percent in the Southwest (SW), 10.8 percent in the Rocky Mountain (RM) area, 10.6 percent in the Plains Region (PR), 6.8 percent in the Great Lakes (GL) area, 4.7 percent in the Mideast (ME) region, and 2.5 percent in New England (not shown in Table 2).

Table 2. 1999 NAR membership profile questionnaire—summary statistics.

Variable	*N*	Mean	Std. Dev.	Minimum	Maximum
Inc	7,525	65,263.46000	62,045.02000	10,000	250,000
HRS	7,599	41.98849	13.35374	20	60
Sch	7,598	14.53053	2.05051	10	20
Exp	7,498	14.59776	10.29179	0	83
Expf	7,485	7.86119	7.82822	0	87
Naff	7,545	1.25593	1.32851	0	6
Female	7,655	0.51914	0.49967	0	1
Married	7,655	0.73390	0.44195	0	1
Nwhite	7,655	0.08478	0.27857	0	1
Broker	7,655	0.28243	0.45021	0	1
Fran	7,655	0.44546	0.49705	0	1
Fsize	7,307	22.90030	17.30595	4	50
BuyAgt	7,655	0.07211	0.25869	0	1
Owner	7,655	0.02443	0.15439	0	1
NE	7,655	0.14265	0.34974	0	1
ME	7,655	0.04677	0.21115	0	1
GL	7,655	0.06832	0.25231	0	1
PR	7,655	0.10581	0.30762	0	1
SE	7,655	0.25291	0.43471	0	1
SW	7,655	0.11927	0.32413	0	1
RM	7,655	0.10764	0.30995	0	1
FW	7,655	0.13142	0.33788	0	1
Software	7,655	1.52061	0.59157	1	4
Email	7,655	0.55794	0.49666	0	1
Internet	7,655	0.56238	0.49613	0	1
Pweb	7,655	0.26310	0.44034	0	1
Cweb	7,655	0.66754	0.47113	0	1
WebLink	7,655	0.05095	0.50217	0	5
Online	7,655	1.18996	0.28731	1	3
TechItem	7,655	1.88077	0.69385	1	4

Data Source: In January 1999, the economic Research Group of the National Association of Realtors® (NAR) sent a membership profile questionnaire to 40,000 randomly selected members of the NAR. Respondents returned 7,655 usable questionnaires that represent a 19.1 percent response rate.

5.1. Technology usage variables

The average number of types of real estate specific software packages used by the respondent (Software), such as Multiple Listing Software or Loan Analysis, is 1.52. The percentage of survey participants who frequently use e-mail for their business (Email) is 55.8 percent, while the percentage of respondents who frequently use the Internet (Internet) for their business is 56.2 percent. The percentage of survey Realtors® who personally have their own World Wide Web home page for business purposes (Pweb) is 26.3 percent, while those with a company World Wide Web home page for business purposes (Cweb) is 66.7 percent. The number of important Web links that a personal Realtor® Web site links into such as "Your office's Web page" or "Mortgage firms' Web pages" averages 0.05 for the entire respondent population. The number of time saving online activities (Online) such as "Participate in business related online discussions" averages 1.19 activities per survey participant. Of eleven possible time saving information technologies such as beeper/pager or cellular phones, the average survey participant uses 1.88 technology items (Techltem).

5.2. Two-step procedure

To examine the multifaceted effects of technology usage on Realtor® income, we employ a two-step procedure. First, we develop factor loadings for the eight different measures of technology

usage, and then we perform a regression analysis of Realtors® income using our primary factor score for technology usage and a variety of licensee (brokers and salespersons) demographic and brokerage firm characteristic variables.

In Table 3, the first factor loadings from the factor analysis performed on the eight technology variables are presented. All eight of the technology variables are positively related to the primary information technology factor. Results from the factor analysis reveal that the information technology variables have two common factors with eigenvalues exceeding 1.0 and with a cumulative explained variation of 50.15 percent. 9 The eigenvalue of primary factor (Multitech) is 3.0. The results indicate all of the technology-use proxies are positively related to the primary information technology factor (Multitech).

The mean of the primary information technology factor is 0.036 with a standard deviation of 0.996. Figure 1 illustrates the distribution of the primary information technology factor.

Results from our regression model with Realtors® income as the dependent variable are reported in Table 4. Statistically significant at the 0.01 level (model F-Value is 216.82), the regression model explains approximately 41 percent of the variation in salesperson income.

The Lhrs variable indicates that net earnings of salespersons increase about 1.15 percent

Table 3. Technology factor analysis.

Technology Variable	Factor Loading	Factor Variance	Scoring Coefficient
Software	0.62368	0.58048	0.20774
Email	0.77510	0.67822	0.25817
Internet	0.78583	0.68812	0.26175
PWeb	0.54207	0.60894	0.18056
CWeb	0.51719	0.54867	0.17227
WebLink	0.20675	0.85635	0.06887
Online	0.63402	0.48504	0.21118
TechItem	0.62362	0.53562	0.20772
Eigenvalue		3.0022	
Proportion of variance		0.3753	

for each 1 percent in hours worked, suggesting increasing returns to additional hours worked. The return per year of schooling is about 2.9 percent. Similarly, an additional year of experience increases earnings about 4.5 percent per year; however, the increase is at a decreasing rate, as indicated by the negative coefficient on the Exp2 variable. Earnings are maximized at 27.3 years.10 Realtor® earnings are directly related to the number of firms with which they have been associated during their career. Real estate brokers earn about 23.1 percent more than salespersons.11 Buyer brokers earn slightly less than traditional real estate salespersons, but the variable is not significant. Married Realtors® earn some 9.2 percent more than whose who are unmarried. Earnings also rise with firm size, but franchise affiliation and firm ownership are not significant.

Only two of the regional dummy variables are statistically significant at the 0.05-level or better, using a two-tail test. The earnings of Realtors® in the Far West are some 12.9 percent higher than in New England, while the earnings of Realtors® in the Southwest average some 7.1 percent less.

The estimated earnings model reveals substantial differentials by race and gender. Nonwhite Realtors® are estimated to earn some 8.2 percent less than equally qualified white Realtors®. Summarily, female Realtors® earn about 3.7 percent less than males. These results are consistent with the findings of Crellin et al. (1988) and Jud and Winkler (1998).

The information technology factor (Multitech) is statistically significant at the 1 percent level, and as expected, shows the expected positive relationship with net earnings. The estimated coefficient indicates that a one-standard-deviation change in technology usage is associated with an 11 percent (0.111*0.996 = 0.111) increase in earnings.

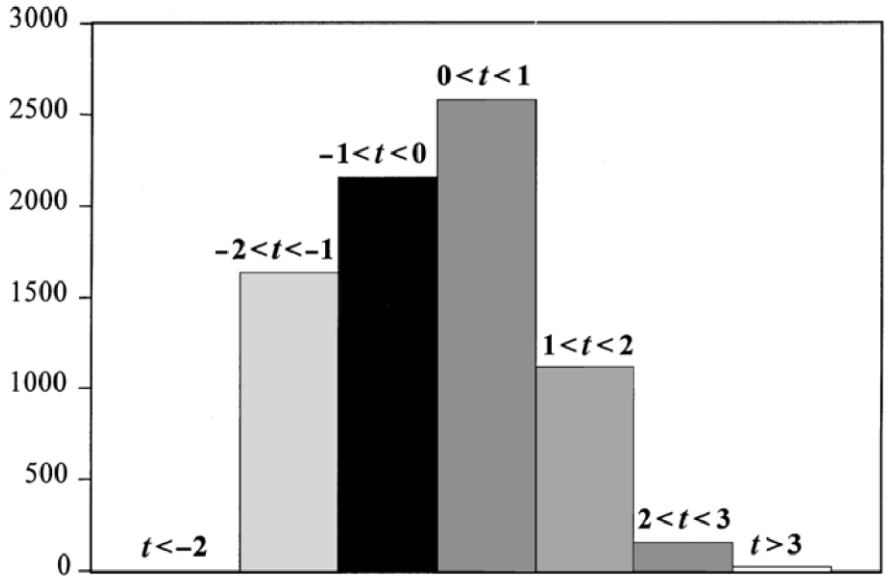

Figure 1. Distribution of information technology factor scores (*Multitech*).

Table 4. Regression analysis of salesperson income.

Variable	Estimate	Standard Error	*T*-Value
Intercept	5.13133	0.12554	40.87*
Lhrs	1.14742	0.02647	43.34*
Sch	0.02859	0.00445	6.43*
Exp	0.04532	0.00285	15.89*
Exp2	−0.00083	0.00006	−13.79*
Expf	0.01558	0.00169	9.19*
Naff	0.02108	0.00867	2.43**
Female	−0.03811	0.01871	−2.04**
Married	0.08832	0.02038	4.33*
Nwhite	−0.08537	0.03302	−2.59*
Broker	0.20764	0.02459	8.44*
Fran	0.01075	0.01944	0.55
Ifsize	0.08533	0.01105	7.72*
BuyAgt	−0.02814	0.03506	−0.80*
Owner	0.11430	0.06150	1.86
ME	0.04728	0.04602	1.03
GL	−0.01248	0.04053	−0.31
PR	−0.00928	0.03516	−0.26
SE	−0.02459	0.02812	−0.87
SW	−0.07347	0.03405	−2.16**
RM	0.05861	0.03474	1.69
FW	0.12128	0.03307	3.67*
Multitech	0.11097	0.00958	11.58*
N	6,807		
Adjusted R^2	0.4109		
Model *F*-Value	216.82		

Dependent variable = Log of salesperson income (*Inc*)
*Indicates significance at 0.01 level, using a two-tailed test.
**Indicates significance at 0.05 level, using a two-tailed test.

5.3. Characteristics of technology users

In order to more closely examine the predictive characteristics for use of technology by Realtors®, we use our technology factor score in a second regression analysis to determine which of a variety of individual Realtor® demographic and firm characteristics are more related to technology usage than other characteristics. The dependent variable here is our technology factor score. As shown in Table 5, all of the variables except Nwhite and Female are statistically significant at the 0.05 level and are signed as expected. We find that Realtor® technology usage increases with schooling, number of firms the agent has worked for, marriage, franchise affiliation, firm size, ownership interest, and hours worked. Technology usage falls, by contrast, with age and experience. Race and gender are statistically insignificant.

Table 5. Regression analysis of technology factor score.

Variable	Estimate	Standard Error	*T*-Value
Intercept	− 2.42003	0.15472	− 15.64*
Lhrs	0.72224	0.03145	22.97*
Age	− 0.01906	0.00111	− 17.12*
Sch	0.03189	0.00553	5.77*
Exp	− 0.00273	0.00138	− 1.97**
Naff	0.04554	0.00913	4.99*
Female	− 0.00217	0.02322	− 0.09
Nwhite	− 0.05551	0.04091	− 1.36
Married	0.13732	0.02542	5.40*
Fran	0.15338	0.02355	6.51*
Fsize	0.00490	0.00068	7.19*
Owner	0.17504	0.07564	2.31**
N	6,807		
Adjusted R^2	0.1545		
Model *F*-Value	114.08		

Dependent variable = *Multitech* (factor score for multifaceted technology usage)
*Indicates significance at 0.01 level, using a two-tailed test.
**Indicates significance at 0.05 level, using a two-tailed test.

6. Summary and observations

As Realtors® continue to be impacted by ever-decreasing costs of information technology and its wider usage by consumers, they will continue to undergo changes in the processes associated with the buying and selling of real estate. These changes will impact both productivity and the income level of Realtors®.

Utilizing the 1999 National Association of Realtors® member profile survey with over 6,000 usable respondent questionnaires, we examine the impact of technology usage on the incomes of Realtors® using a two-step procedure. We first develop factor loadings, using factor analysis, for multifaceted technology usage by Realtors®. We then perform a regression analysis of Realtors® income incorporating a variety of independent variables including licensee (brokers and salespersons) demographics and brokerage firm characteristics as well as the factor score for technology usage. Our results show that, on average, Realtors® who increase their use of information technology by one standard deviation unit raise their earnings by 11.1 percent. These results suggest that information technology offers the potential for substantial income gains. 12

We use our technology factor score in a second regression analysis to determine which of a variety of individual Realtor® demographics and brokerage firm characteristics are more related to technology usage than other characteristics. We find that technology usage increases with schooling, number of firms the agent has worked for, marriage, franchise affiliation, firm size, ownership interest, and hours worked. Technology usage falls, by contrast, with age and experience. The results of this paper should expand our knowledge concerning real estate technology use behavior and related income.

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Notes

1. Greater use of technology may also require increased capital investment by real estate brokerage firms and, in turn, influence brokerage firm profitability levels.
2. In their recent paper on ``Real Estate and Technology," The National Association of Realtors (1999) recently noted: ``The industry has moved from the `big book' of MLS property listings accessible only by real estate professionals to properties posted on Web sites that anyone with a PC and Internet access can view. Real estate agents have progressed from using only direct mailings of postcards to potential clients to personal World Wide Web pages that allow consumers to e-mail agents directly about specific properties or neighborhoods."
3. In some areas, MLS access is limited to members of the local board. However, this policy is not universal.
4. In examining the impact of technology on the brokerage industry, we assume that brokerage services are produced with a standard Cobb—Douglas production function exhibiting diminishing marginal returns to each factor of production and constant returns to scale. Information technology is included as a specific input in the production process; thus, the quantity of brokerage services produced (Q) is given by

$$Q = f(K, L, IT)$$

where
Q = the quantity of brokerage services produced;
K = capital;
L = labor;
IT = information technology.
Because brokerage firms operate within the region of diminishing marginal returns, the supply curve for brokerage services is upward sloping and is given by

$$Q_S = Q_S\ (P,\ P_I)$$

where
Q_S = the quantity of brokerage services supplied;
P = the price of brokerage services;
P_I = the prices of inputs (labor, capital, and information technology);
The marginal effect of an increase in price (P) or a fall in the price of an input [capital (K), labor (G), and information technology (IT)] is to increase the quantity of brokerage services supplied (QS). On the demand side, the use of technology affects the brokerage business by making it easier for consumers to search the housing market on their own, and, thus, it decreases the demand for brokerage services.
5. The regional dummy variable classifications are taken from the United States Department of Commerce, Bureau of Economic Analysis. The New England region is omitted; thus, the estimated coefficients for the regional variables reflect average differences between the particular regions and the New England area.
6. Possible page links include: (a) Your office's Web pages, (b) Your franchise company's Web Page, (c) Mortgage firms' Web pages, (d) Local chamber of commerce Web page, and (e) Local schools/governments' Web page(s).
7. The complete list of technology items include beeper/pager, calculator, cellular phone, CD ROM, copy machine, digital camera, fax machine, laser printer, modem, personal digital assistant, and scanner.
8. The National Association of Realtors® is comprised of real estate professionals involved in all aspects of the real estate industry (but mostly brokers and real estate salespersons), and who subscribe to a strict Code of Ethics.

9. The second factor has an eigenvalue of 1.01 and an explained variation of 12.62 percent, while the third factor has an eigenvalue of 0.97 and an explained variation of 12.12 percent. The pattern relating the eight technology variables to the second and third factors, however, has no logical explanation nor were any of these factors statistically significant in the regression analysis.
10. The number of years of experience is determined by taking the derivative of equation (4) with respect to Exp, setting the derivative equation equal to 0, and solving for Exp.
11. The estimated percentages can be determined by the following transformation: exp(D) -1, where D is the dummy variable coefficient.
12. Our earnings model posits that technology usage influences earnings; however, earnings could also influence technology usage. The use of simultaneous regression equations for earnings and the technology factor is problematic because of the need to identify variables that impact only the technology factor score but not earnings. Future research might investigate the potential causality linkage between technology use and earnings using a different modeling approach.

References

Barta, P. (2000). "Realtors® Invest in Job Security on the Internet," Wall Street Journal, November 6, B1. Benjamin, J. D., G. D. Jud, and G. S. Sirmans. (2000). "What Do We Know About Real Estate Brokerage?" Journal of Real Estate Research 20(1-2), 5-30.

Crellin, G., J. R. Frew, and G. D. Jud. (1988). "The Earnings of Realtors: Some Empirical Evidence," Journal of Real Estate Research 3(2), 69-78.

Follain, J. R., T. Lutes, and D. S. Meier. (1987). "Why Do Some Real Estate Salespeople Earn More Than Others?" Journal of Real Estate Research 2(3), 73-81.

Guidera, J. (2000). "Antitrust Investigation of Homestore is Focusing on Exclusive Listing Pacts," Wall Street Journal, September 20, C22.

Jud, G. D., and D. T. Winkler. (1988). "The Earnings of Real Estate Salesperson and Others in the Financial Services Industry," Journal of Real Estate Finance and Economics 17(3), 279-291.

Jud, G. D., D. T. Winkler, and G. S. Sirmans. (2000). The Impact of Information Technology on Real Estate Licensee Income. Greensboro, NC: UNCG, Bryan School of Business & Economics.

MacGregor, R. C., and D. J. Bunker. (1999). "A Comparison of Real Estate Brokers Computer Training Needs withother Small Business Sectors: An Australian Perspective," Journal ofReal Estate Practice and Education 2(1),1-12.

Mincer, J. (1970). "The Distribution of Labor Incomes: A Survey with Special Reference to the Human Capital Approach," Journal of Economic Literature 8(1), 1-26.

National Association of Realtors®. (1999). "Real Estate and Technology: Realtors® and the New Business Environment" Kevin A. Roth, Principal Investigator.

National Association of Realtors%. (2000). "The 2000 National Association of Realtors Profile of Home Buyers and Sellers" Kevin A. Roth, Principal Author.

Rich, M. (2000). "For Brokers, the Interact Looms Ever Larger," Wall Street Journal, August 23, B12. Sirmans, G. S., and P. G. Swicegood. (2000). "Determining Real Estate Licensee Income," Journal of Real Estate Research 20(1-2), 189-204.
Tessler, J. (1999). "More People Turn to Web to Buy, Sell Homes," The Wall Street Journal, July 8, B9.